Verticillium Stripe of Canola

Key Points:

- Verticillium stripe is a soil-borne disease of canola first found in Canada in 2014 in Manitoba.
- Soil surveys conducted by the Canadian Food Inspection Agency in 2015 found *V. longisporum* throughout canola-growing provinces in Canada.
- Due to the late onset of the disease, verticillium stripe is less damaging than other diseases such as blackleg or Sclerotinia stem rot.

Disease Facts

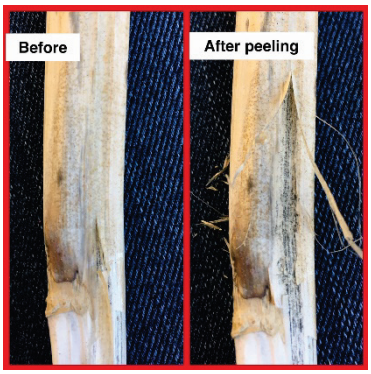
- Verticillium stripe of canola is caused by the fungal species *Verticillium longisporum*. This is related to, but not the same as, *Verticillium dahliea*, which is a pathogen of potato, tomato, sunflower, strawberry, cabbage, and maple.
- Verticillium stripe is a soil-borne disease and as such will have similar management practices to clubroot (which is also a soil-borne disease). Fungal propagules called **microsclerotia** are present in soil or dead plant tissue.
- *V. longisporum* is known to infect numerous annual and perennial species in both temperate and subtropical zones.
- Its host range includes several crop species, such as broccoli, cabbage, horseradish, radish, and canola along with wild mustard in the mustard family. It has been an economically important pathogen of oilseed rape in northern Europe for over 30 years and has also been found in cauliflower in California and horseradish in Illinois.
- The pathogen is taken up by the roots and moves up into the stem, plugging up the xylem.
- Verticillium stripe is a monocyclic disease, meaning it only goes through one cycle of the disease each year. However, if infected plants ripen prematurely, they can have reduced yield.
- Yield losses up to 50% have been observed in Europe, but the potential impact on spring-seeded canola in Canada does not appear to be as great.

Conditions Favoring Disease

- Verticillium stripe is favored by hot and dry conditions. Soil temperatures between 59 and 66 °F and air temperatures around 73 °F are optimal for disease development.
- The disease is less of an issue with high levels of soil moisture.
- Plants with damaged roots are more susceptible to the disease entering the vascular system.

Symptoms

- Disease symptoms include leaf chlorosis, early ripening, stunting, and necrosis (shredding of the stem tissue).
- Symptoms are primarily visible on the stem and roots but can also be noticed on leaves and pods.
- Infection can occur in patches or across the entire field.
- The interference of water and nutrient uptake caused by verticillium stripe can cause the crop to show signs of stunting and premature senescence.
- Faint black vertical striping can be seen on the stems which can appear darker or more obvious when rubbed.
- Peeling back the epidermis and outer cortex of the stem, the striping will become more obvious farther into the maturation process due to the tissue dying below the stem surface.
- Once the plant is fully ripe, the stem peels to reveal tiny black **microsclerotia**, which can resemble ground pepper in appearance.
- These **microsclerotia** remain on the plant stem or fall to the soil. Those in stems are released in the soil as the stems decay.
- **Microsclerotia** are hardy and can survive in the soil for many years.
- **Microsclerotia** can move with surface and ground water, through wind dispersal of infected soil or crop debris, equipment contaminated with infected soil or crop debris, seed contaminated with infested soil or crop debris, and people from one field to another.



Before and after peeling epidermis to reveal microsclerotia



Peeling epidermis to reveal microsclerotia

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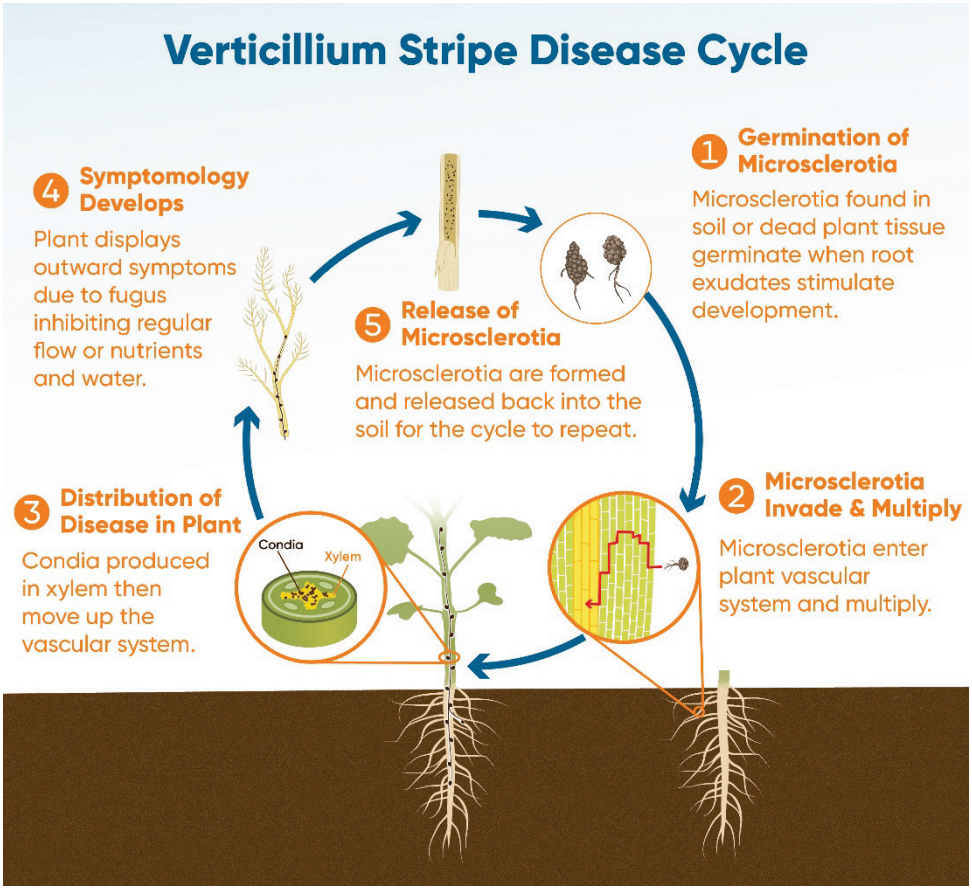


Figure 1. Verticillium stripe disease life cycle.

Disease Life Cycle

- The rapid germination of microsclerotia in the soil is triggered by the root exudate (fluids emitted by the roots). This is necessary in order to successfully infect the roots at the most susceptible location of the fast-growing root tip.
- Additionally, the timing of the commencement of flowering plant stage has been said to be important to the spread of *V. longisporum* in canola, when the plant is believed to be the most susceptible.
- The fungus can enter the vascular system by root directly or through an open wound in the root via fungal hyphae.
- After the hyphae multiply in the root, hyphae and single-cell spores called **conidia** are produced locally in the xylem and move through the vascular system of the plant to multiply.
- This inhibits the flow of water and nutrient up to the plant tissues eventually causing the xylem to plug, turn black, collapse, and shrivel.
- The pathogen then moves into non-vascular tissue where microsclerotia are formed. The microsclerotia are released in the soil and the cycle repeats.

Reference

Canola Council of Canada – Canola Encyclopedia
https://www.canolacouncil.org/canola-encyclopedia/diseases/verticillium-stripe/

All images from the Canola Council of Canada

Scouting Tips

- It is best to start looking for symptoms after flowering, although symptoms are not typically observed until later in the growing system when plants are near maturation.
- Post-harvest or after swathing may be the best time to scout for this disease when you are also looking for blackleg, white mold, and clubroot.
- Verticillium stripe can easily be mistaken for other diseases such as blackleg and Sclerotinia stem rot at first.
- While shredding of the stem is similar to Sclerotinia stem rot, the large sclerotia and hollowing inside the stem of Sclerotinia is different than the tiny microsclerotia of verticillium stripe.
- Discolored stems and premature ripening can also be symptoms of blackleg. Cutting the stem at ground level and observing a cross-section of the stem can clarify. Blackening inside the stem will identify blackleg, as opposed to the stem with no blackening in the stem cross-section.



Root cross-section of plants prior to harvest. Verticillium stripe (left), blackleg (middle), and healthy plant (right).

Management

- There are no foliar or seed treatment fungicides currently registered for control of Verticillium stripe in canola.
- At this time there is no characterized host resistance in canola hybrids to *V. longisporum;* however, differences in susceptibility between hybrids have been reported.
- In northern Europe, where this disease has been an important issue for more than 30 years, it is recommended that growers leave 3 years between canola crops. This allows the pathogen population to naturally decline in the soil, but due to the long lived microsclerotia, rotation alone is not enough to manage this disease effectively.

The foregoing is provided for informational use only. Please contact your Pioneer sales professional for information and suggestions specific to your operation. Product performance is variable and depends on many factors such as moisture and heat stress, soil type, management practices and environmental stress as well as disease and pest pressures. Individual results may vary. CF210811

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